Review and Response to Questions
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Goals: limit at which further withdrawals would be *significantly harmful* to water resources or ecology of the areas

Significant harm: temporary loss of water resource functions… that take longer than two years to recover

Lake Istokpoga is a natural lake that provides important ecological services including (see list page 4):

- Fisheries (both recreational and commercial);
- Wildlife (e.g., large osprey populations, bald eagles, etc);
- Home to distinctive, if not unique, fringing cypress swamp (certainly a beautiful location).

Ecological harm would include, but possibly not be limited to:

- Loss of fishery characteristics;
- Change in trophic status of lake leading to low DO, continued accumulation of organic matter;
- Loss of bird populations;
- Loss of habitat character (fringing cypress swamp).

Key point: Three dimensions to MFL regulation for this lake are minimum depth, max length at depth, return time

1. a. Does the MFL document present a defensible scientific basis for setting initial flows and levels within this water resource?

The primary basis for the Minimum water level of 36.5 ft seems to be bathymetry of the lake and associated vegetation. Literature is reported indicating minimum hydroperiods needed to maintain the various vegetation types at key elevations. The duration of such low-water events appears to derive from experience obtain in the 2001 drought and draw-down event. That event lasted 19 weeks and may have provided benefits to fisheries, at least over a several year time interval. The return time for the minimum levels seems to be derived primarily from fisheries concerns and recruitment dynamics, though the connection is verbal.

Tugend and Allen (2004) provides a basis for using drawdown and herbiciding as a management tool for a similar lake in the same drainage

2001 was only one event… not replicated, endpoints could be different due to details of when in year and rate of water decline

1. b. Are the approaches described scientifically sound based on 'best available information'?

Sticking to my own area of expertise, aquatic ecology and fishes, I found the fisheries material presented to be lacking. A report from the FWC is cited, but the tabular and graphical materials reproduced were not cogent to the arguments made. It is not clear to me if the necessary information is actually present in the reports, but statements made regarding the impact of the 2001 management actions or other periods must be taken on face value. That written, I found the conclusions drawn consistent with my expectations and suspect that they are correct, for whatever that's worth. Results are consistent with recommendations for Florida fisheries management in Aumen and Gray (1995), Moyer et al. (1995), Allen et al. (2002), and Bonvechio and Allen (2003). Note that Aumen and Gray (1995) provide a basis to use historical ecological variation as a management target (rather than single-species goals that often yields conflicting recommendations across taxa).

My own work in the Everglades supports the idea that the longer the minimum level is retained, the more severe the mortality incurred by fish populations and the longer time required for recovery post-disturbance (Trexler et al. 2005). However, the population-level impact may be a minor component of the long-term population dynamics of fishes in a lake where large areas of aquatic habitat will be retained in low-water years and no aquatic taxa are actually at risk to be driven extinct. The return time of minimum levels (proposed to exceed four years) could also have major implications for population and community dynamics. The proposed minimum return time of four years is not well justified in the current document. However, four years seems reasonable in permitting recovery of aquatic communities from drought, and the generation time and age of first reproduction of the longest-lived fishes in the system. It would be nice to have a time series of population data from key fisheries taxa to exam this expectation. Bonvechio and Allen (2003) elaborate on these issues in the context of setting MFL for rivers and lakes in Florida. Again *for what its worth*, our data from the Everglades (parts of WCA-3A have some similarities to this lake), suggest that four years between droughts is a minimum to recover long-lived fish species and their communities both in terms of relative abundance of 'desirable' species like bass and their consumptive impact on prey species (Chick et al. 2004; Trexler et al. 2005). Data from Lake Istokpoga are sorely needed in this report.

One aspect of the impact of a low-water event is its timing with regard to fish recruitment. I know that M.S. Allen (UF) has worked on the relationship of largemouth bass recruitment in Lake Istokpoga and hydrology, but none of his work is mentioned here. Perhaps this is reviewed in the FWC's report? The current plan assumes that the 2001 timing is consistent with any future drying event… is that reasonable?

Pages 52-53 mention mercury consumption advisory that is in effect. There was little concern about this in our visit to the lake. Was there any effect of the 2001 management action on mercury levels in fish?

2. Are the proposed criteria logically supported and what additions, deletions, or changes are recommended?

The report is impressive in the breadth of material considered. Presumably the ecological data available for such an analysis are limited and concepts must be drawn from nearby systems where information is available. Ideally, there would be more quantitative data on ecological relationships of aquatic communities to water levels, water-level fluctuation, and drought return times. For me, a telling comment in the document was that cypress and mixed hardwood communities that historically fringed the lake are no longer producing recruits because of hydrological stabilization. Some quantitative data on this would be useful. However, since this criterion does not address operation schedules per se, this clear 'harm' of ecological function is not explicitly addressed. Clearly, periodic excursions to the minimum level proscribed here may actually be *mandatory* to avoid 'harm' to ecological structure of the remaining habitat of the lake.

3. Are there other approaches to setting the criteria that should be considered?

I found the review of approaches used by St Johns WMD and Southwest Florida WMD useful in setting a context for this analysis. I do not have suggestions for alternative approaches at this time. However, a stronger case could have been made through the use of simulation models to justify the choice of return time for the minimum level. I'm surprised that some general analysis of this type that identifies key parameters to be tracked for specific lakes has not been developed by the FWC. The use of GIS and bathymetry for proposing the level was convincing, when linked to the practical issues of navigation, etc. It would seem that the FWC would actually have fisheries monitoring data that would permit development of a statistical relationship of fish population dynamics and length of dry-down. Further, I know that the seasonal timing of the dry-down has a huge impact on nesting and recruitment success. This is not addressed in the current report... this is more relevant to regulatory schedule.

I have noted a few problems in reporting references in the notes below. Notes made while reading the text:

Page 21: What is the composition of the materials in Undiffertiated clastic deposits and Tamiami Formation and the Hawthorn Group geological units? The lower deposits are all limestone. I wondered about this because of the implications of these materials on nutrient dynamics on the surface water and then became frustrated by the lack of consistency in reporting in this table.

Page 37: Cypress swamp mixed veg is not reproducing because of water level stabilization. This seems important and warrants elaboration and DATA presentation

Page 38: References hard to follow: FWC 2003… no such reference; Champeau 2003 is listed as 2004 in the literature cited section

Page 39: Several errors in taxonomy need correcting… I caught these (the correct names listed below, should be easy to link to errors on the page):
Gambusia holbrooki
Notropis emiliae
Ameiurus natalis
Tadpole madtom

Pages 40-41: Conclusions about recruitment and age classes, etc, cannot be inferred from figures 20 and 21. There is no evidence to support the statements listed and the figures are useless. Need to insert graph showing length by age or otherwise indicate cohorts on the length-frequency histograms to make this useful.

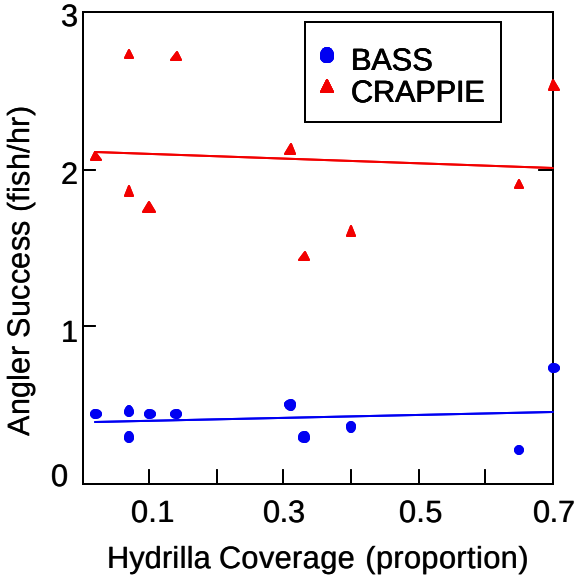
Page 52: FWC 2002 reports that fish surveys indicated an increase in fish species richness and abundance following 2001 drought/drawdown/vegetation control; No data are presented to support this contention… are such data in the FWC report?

Page 53: Lake has mercury alert for fish consumption; what is status in years since 2001? Is there any evidence that drawdown had an impact (positive, negative, none) on mercury levels in key taxa?

Page 54, Table 10: No measure of repeatability on these numbers…. 2000-2001 data are clearly skewed by low water/concentration event. This table tells us nothing about fisheries; pre-drawdown data are lower and higher for all taxa. Sunfish reporting is particularly useless with a change in reporting in mid-project. Are the two species summed comparable to the data from 1991 – 1995? No explanation or quantitative linkage was made between *Hydrilla* data and fisheries (see Allen et al. 2003, who also found no relationship in these variables). Since these data don't show a relationship, why are they reported… what's the point?

Table 1. Pearson correlations of data from FWC (2003). None are significant.

	HYDRILLA	BASS	CRAPPIE
HYDRILLA	1		
BASS	0.16	1	
CRAPPIE	-0.079	0.593	1



P70: need to report the 'significantly altered' term per SWFWMD for clarity

Page 71: need definition of 'significantly altered' or note that none is available.

Page 78: Vegetation management effects and low water on nutrient releases not established well enough to include in this analysis.

Page 91: Concludes that 2001 drawdown event caused only short-term negative impact on some fish communities; can't evaluate that from data presented.

Page 94, bottom: periodic short-duration low-water events don't create harm… could mention benefits here. Recruitment of cypress requires dry periods in fringing swamp habitat?

Page 98: Criterion relies on 2001 experience where drawdown below 36.5ft for 19 weeks did not lead to "harm"

Page 100: Monitoring strategy DO? Should provide a table of monitoring provided by Florida Lakewatch and those parameters deemed critical for monitoring MFL… can't assume Lakewatch continues to provide quality data on this system for enforcement into indefinite future. More data on fisheries monitoring is needed… what is actually being done and what is critical to evaluate MFL? Also, need monitoring of vegetation independent of enhancement projects. This should include cypress swamp vegetation, with ability to track recruitment.

Literature cited or that should be considered for citation in this report:

Allen, M. S., K. I. Tugend, and M. J. Mann. 2004. Largemouth bass abundance and angler catch rates following a habitat enhancement project at Lake Kissimmee, Florida. North American Journal of Fisheries Management 23:845-855

Allen, Micheal S. and Kimberly Tugend. 2002. Effects of a large-scale habitat enhancement project on habitat quality for age-0 largemouth bass at Lake Kissimmee, Florida. Proceedings of the International Black Bass Symposium 2000, American Fisheries Society, Bethesda, Maryland.

Aumen, N. G., and S. Gray. 1995. Research synthesis and management recommendations from a five-year ecosystem-level study of Lake Okeechobee, Florida (USA), Archiv fur Hydrobiologie 45:343-356

Bonvechio, T. F., and M. S. Allen. 2005. Relations between hydrologic variables and year class strength of sportfish in eight Florida waterbodies. Hydrobiologia 532:193-207

Chick, J. H., C. R. Ruetz III, and J. C. Trexler. 2004. Spatial scale and abundance patterns of large fish communities in freshwater marshes of the Florida Everglades. Wetlands 24:652-664

Moyer, E. J., M. W. Hulon, J. J. Sweatman, R. S. Butler, and V. P. Williams. 1995. Fishery responses to habitat restoration in Lake Tohopekaliga, Florida. North American Journal of Fisheries Management 15:591-595

Trexler, J. C., W. F. Loftus, and S. Perry. 2005. Disturbance frequency and community structure in a twenty-five year intervention study. Oecologia, in press (proof is attached)

Tugend K.I. and M. S. Allen. 2004. Changes in the plant and fish communities in enhanced littoral areas of Lake Kissimmee, Florida, following a habitat enhancement. Lake and Reservoir Management 20:54-64

Walker, W. W. and K. E. Havens. 2003. Development and application of a phosphorus balance model for Lake Istokpoga, Florida. Lake and Reservoir Management 19:79-91